Fig. 1

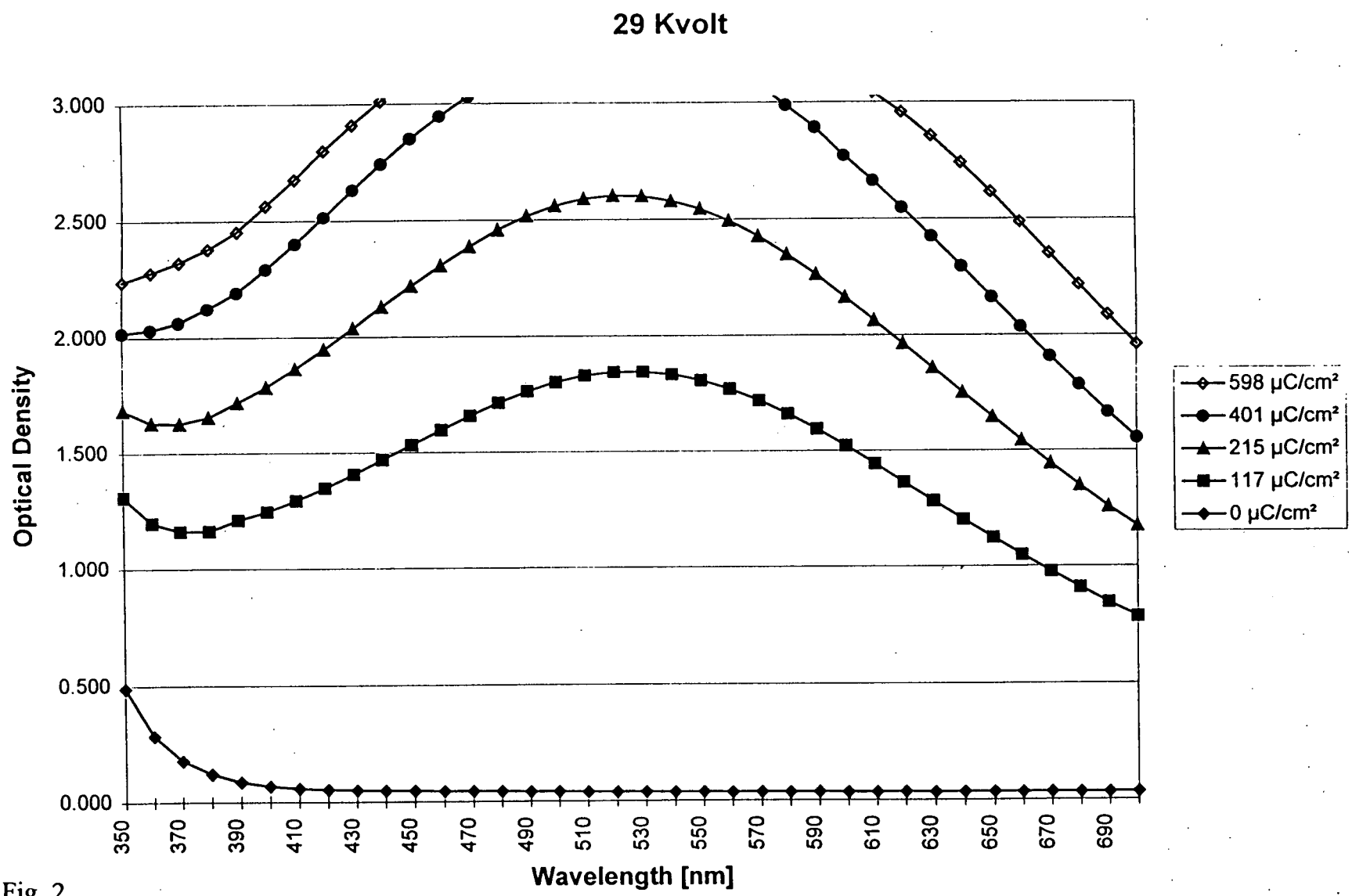


Fig. 2

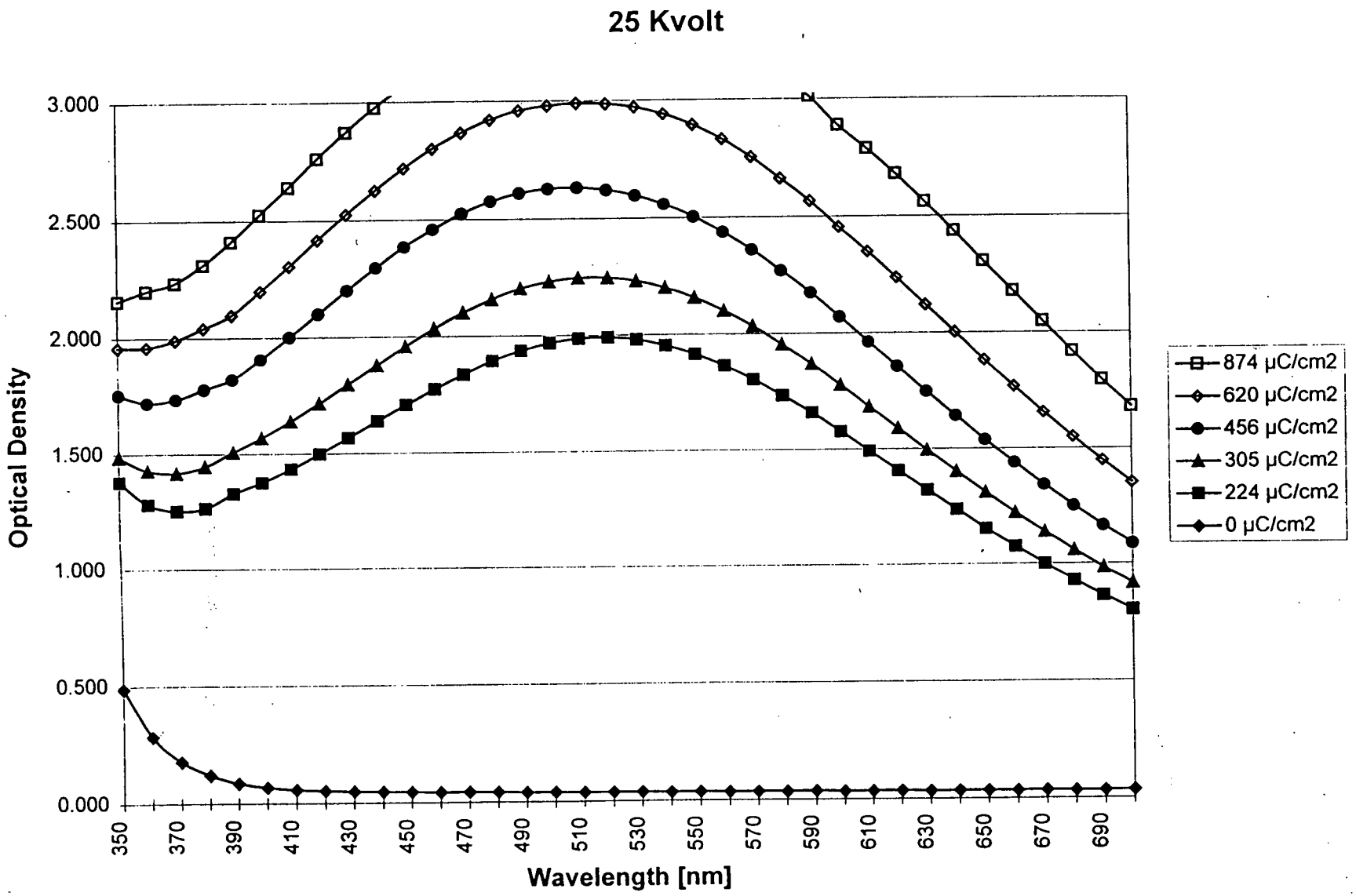


Fig. 3

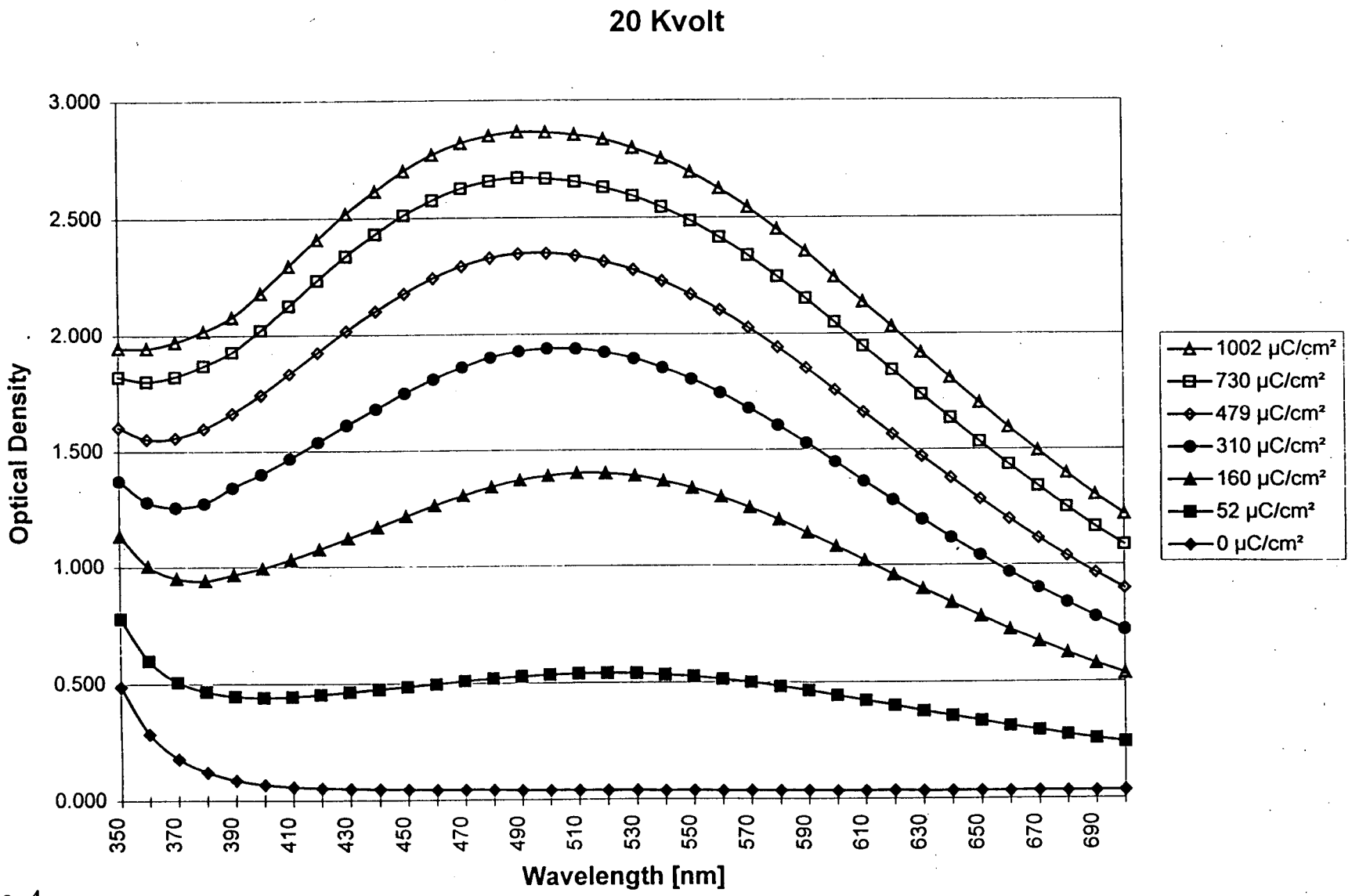


Fig. 4

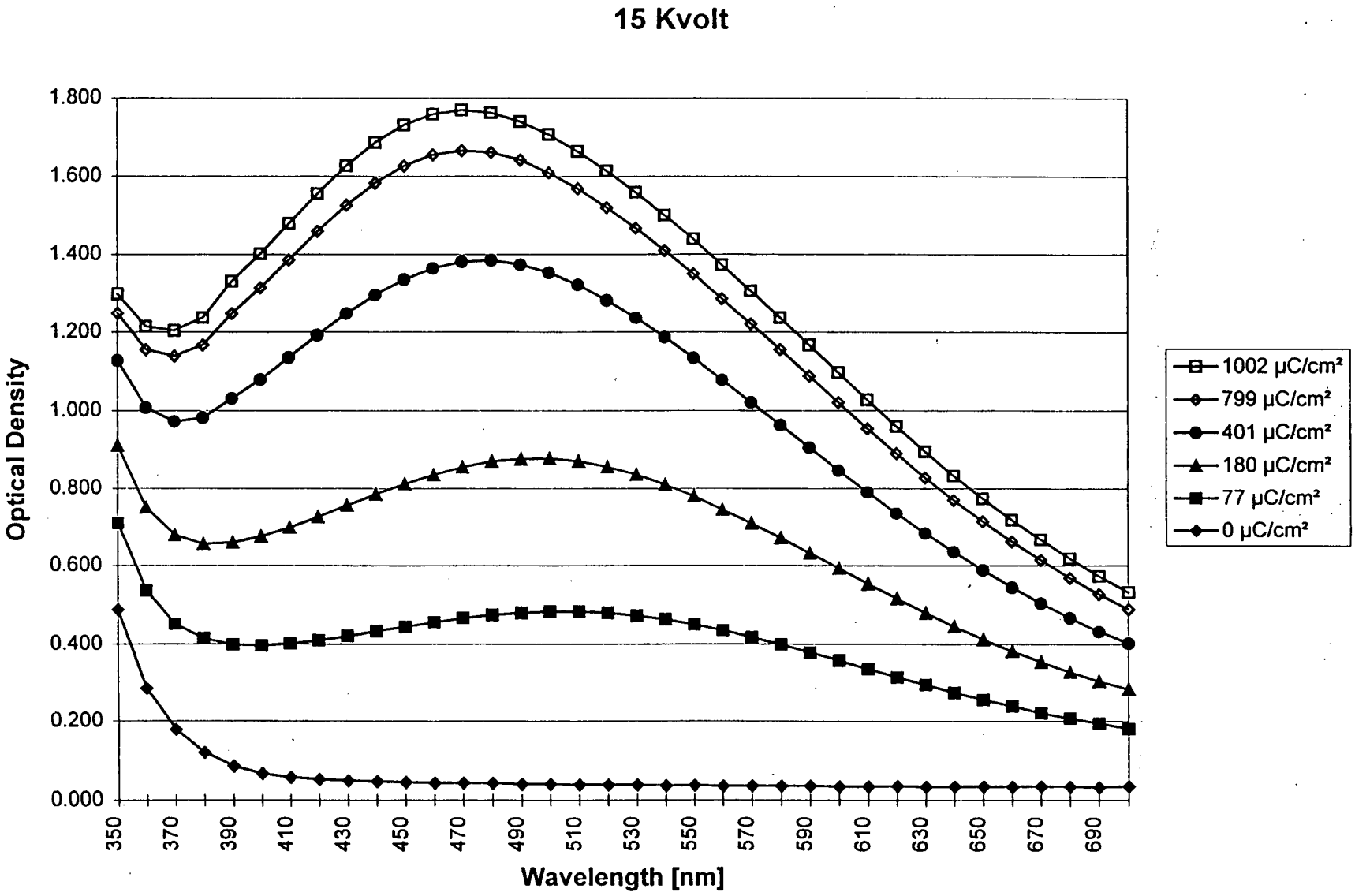

15 Kvolt
Optical Density
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
350
370
390
410
430
450
470
490
510
530
550
570
590
610
630
650
670
690
Wavelength [nm]
1002 µC/cm²
799 µC/cm²
401 µC/cm²
180 µC/cm²
77 µC/cm²
0 µC/cm²

Fig. 5

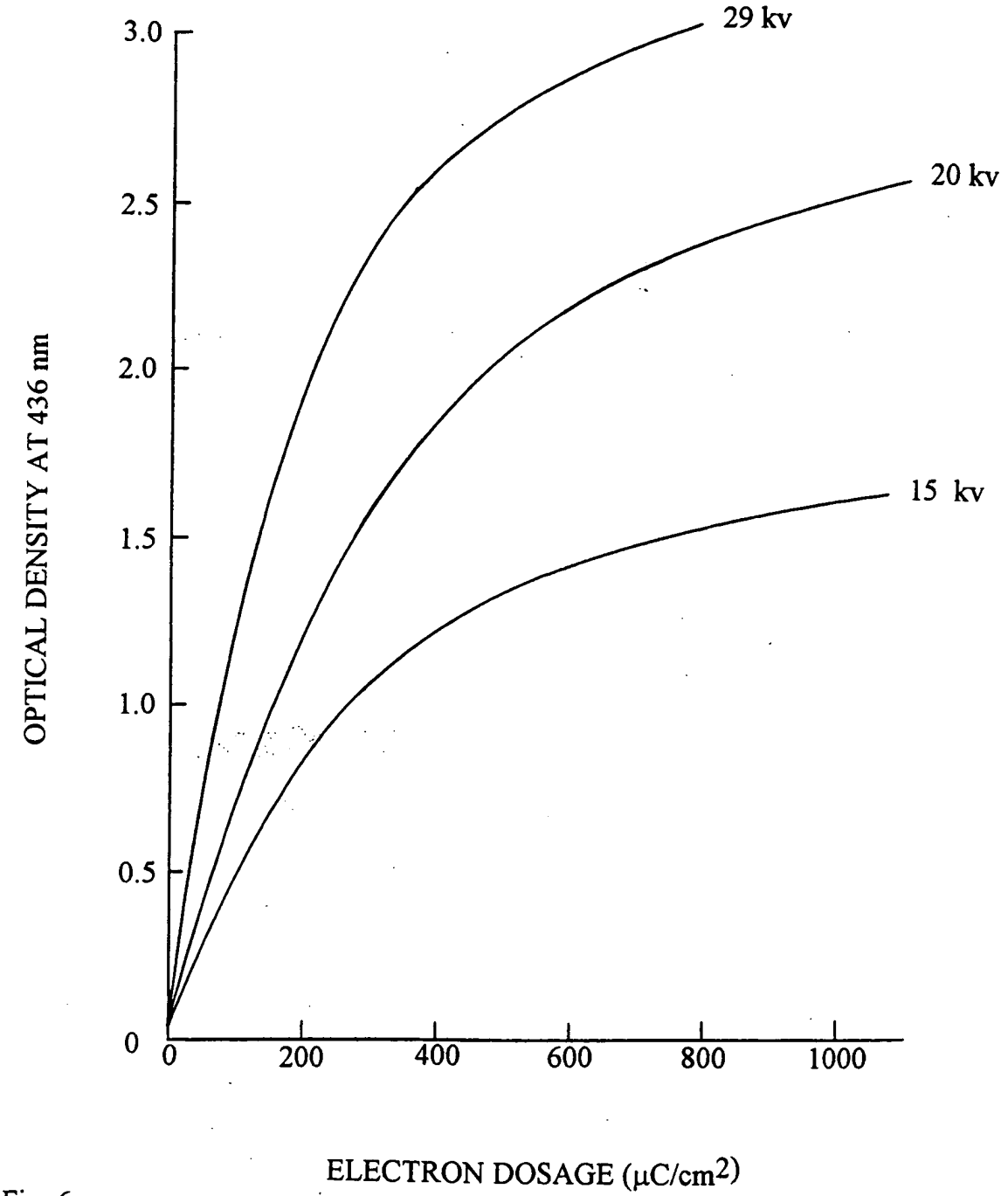


Fig. 6

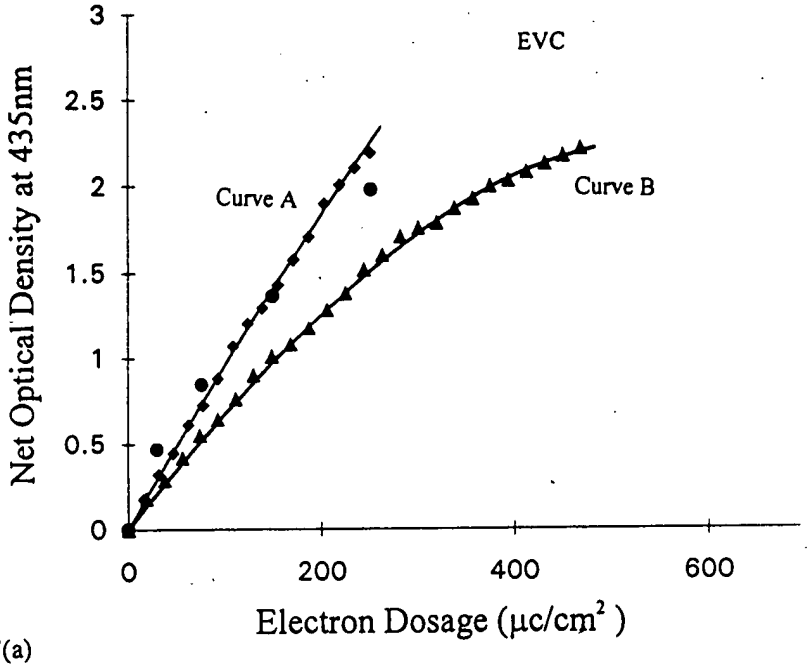


Fig. 7(a)

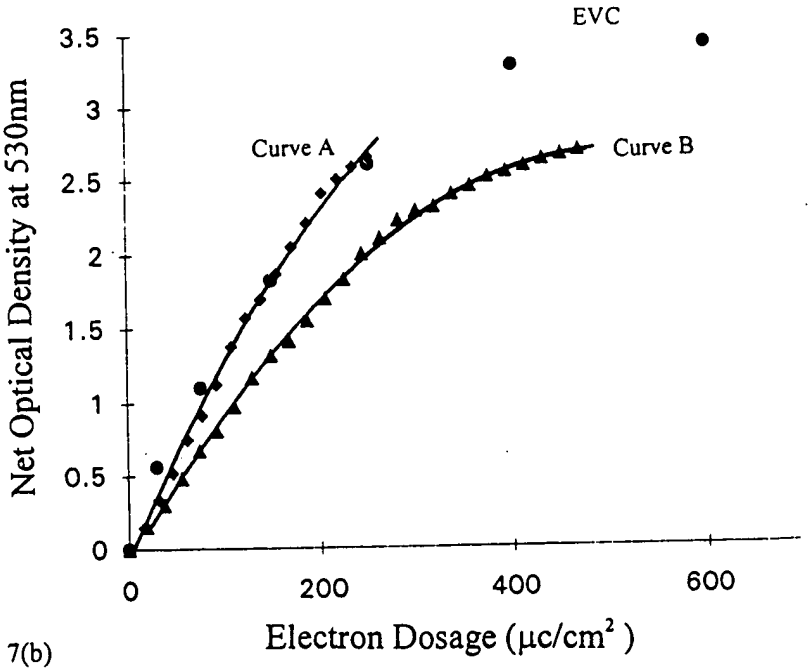


Fig. 7(b)

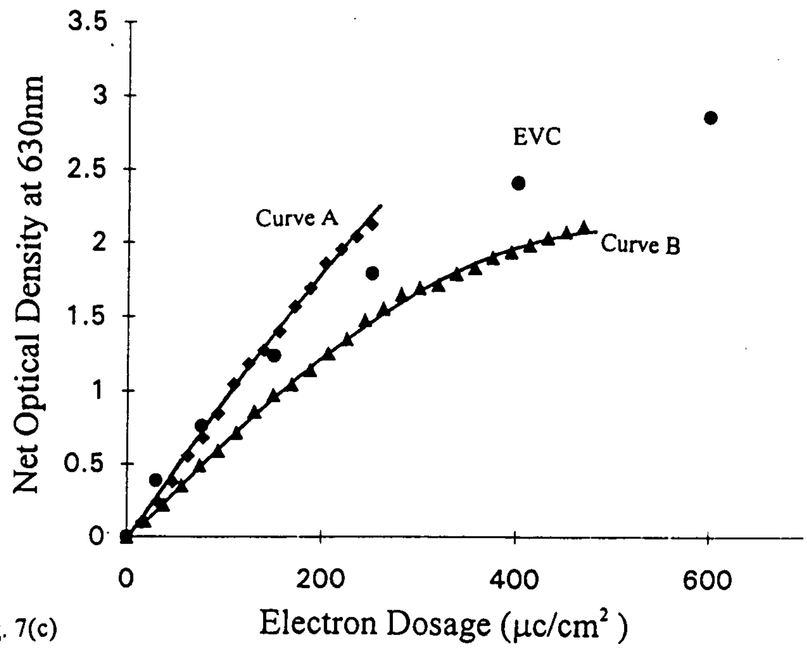


Fig. 7(c)

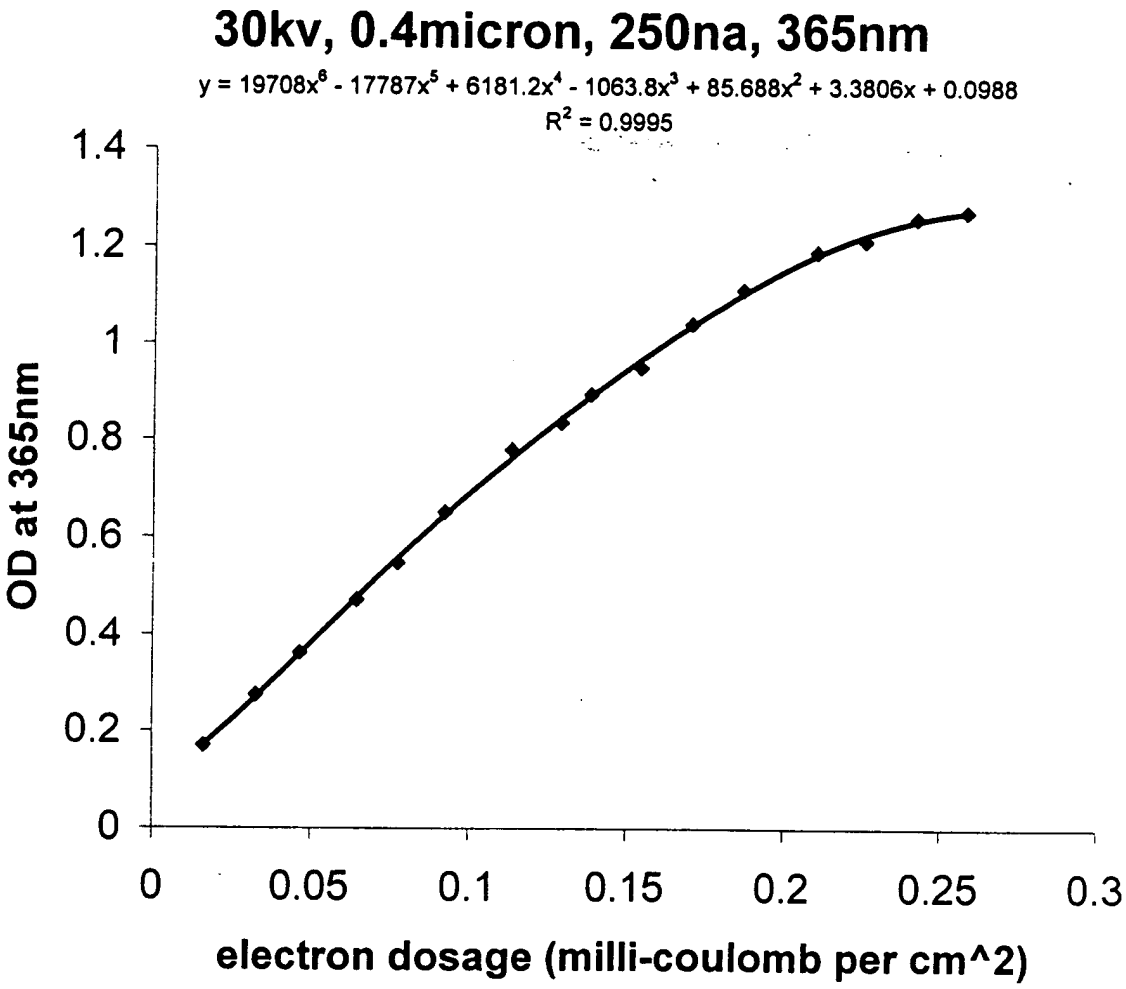

30kv, 0.4micron, 250na, 365nm
y = 19708x^6 - 17787x^5 + 6181.2x^4 - 1063.8x^3 + 85.688x^2 + 3.3806x + 0.0988
R^2 = 0.9995
OD at 365nm
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
0.05
0.1
0.15
0.2
0.25
0.3
electron dosage (milli-coulomb per cm^2)

Fig. 7 (d)

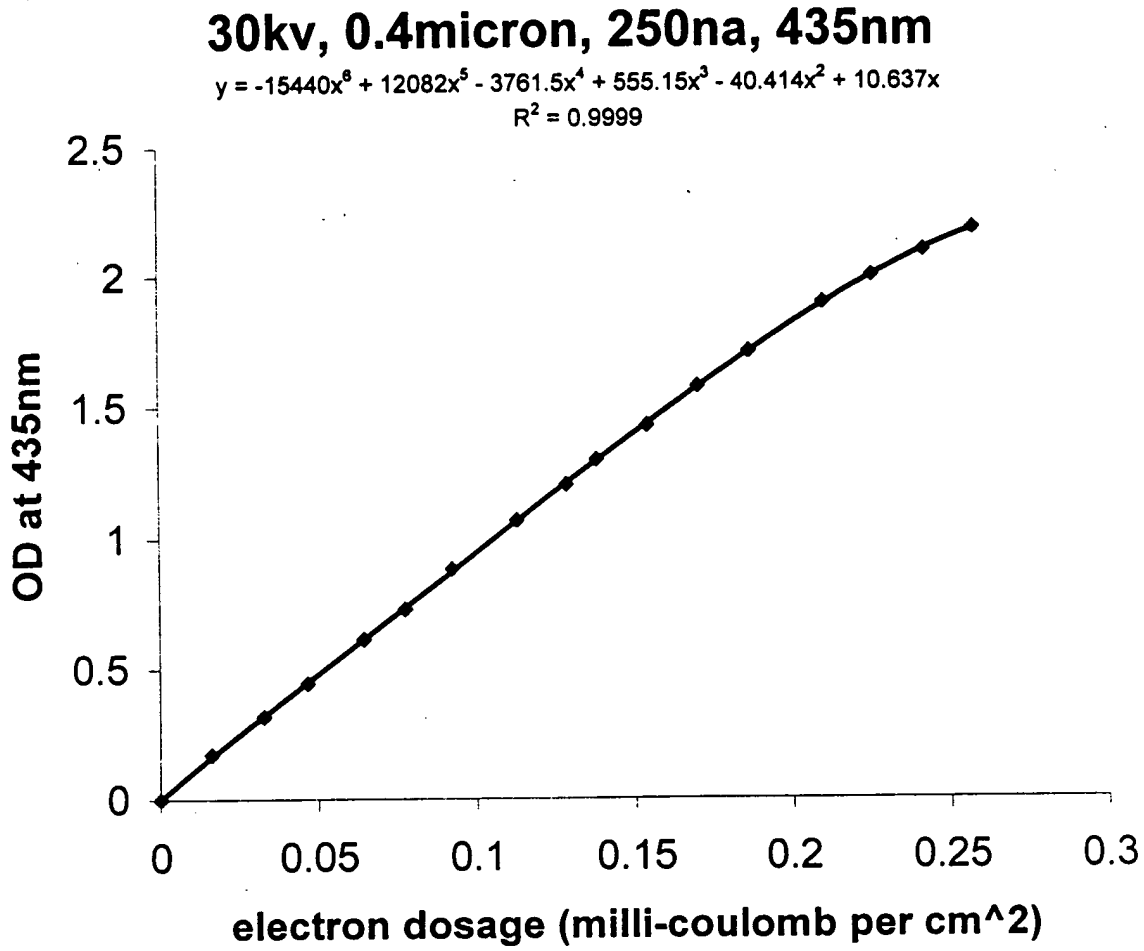

30kv, 0.4micron, 250na, 435nm
y = -15440x^6 + 12082x^5 - 3761.5x^4 + 555.15x^3 - 40.414x^2 + 10.637x
R^2 = 0.9999
OD at 435nm
2.5
2
1.5
1
0.5
0
0
0.05
0.1
0.15
0.2
0.25
0.3
electron dosage (milli-coulomb per cm^2)

Fig. 7 (e)

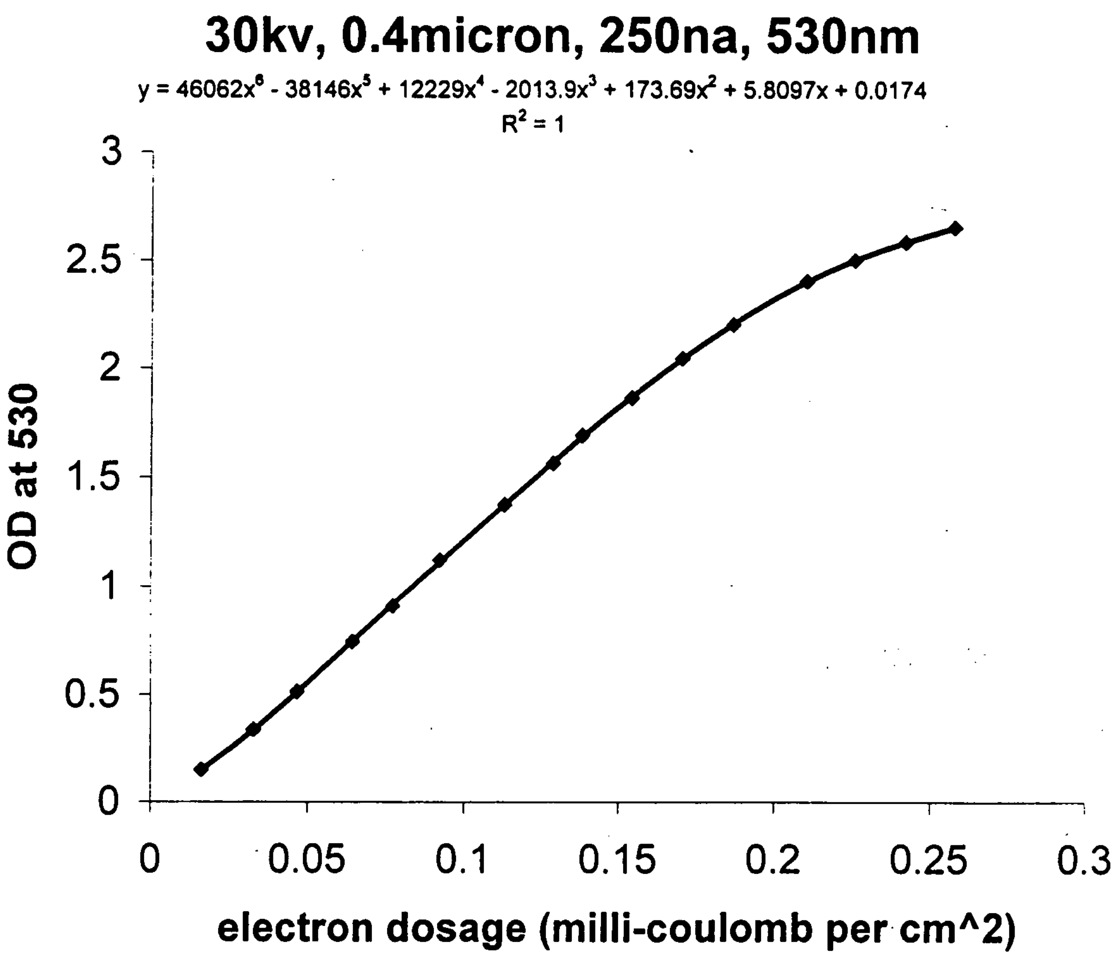

30kv, 0.4micron, 250na, 530nm
y = 46062x^6 - 38146x^5 + 12229x^4 - 2013.9x^3 + 173.69x^2 + 5.8097x + 0.0174
R^2 = 1
OD at 530
3
2.5
2
1.5
1
0.5
0
0
0.05
0.1
0.15
0.2
0.25
0.3
electron dosage (milli-coulomb per cm^2)

Fig. 7 (f)

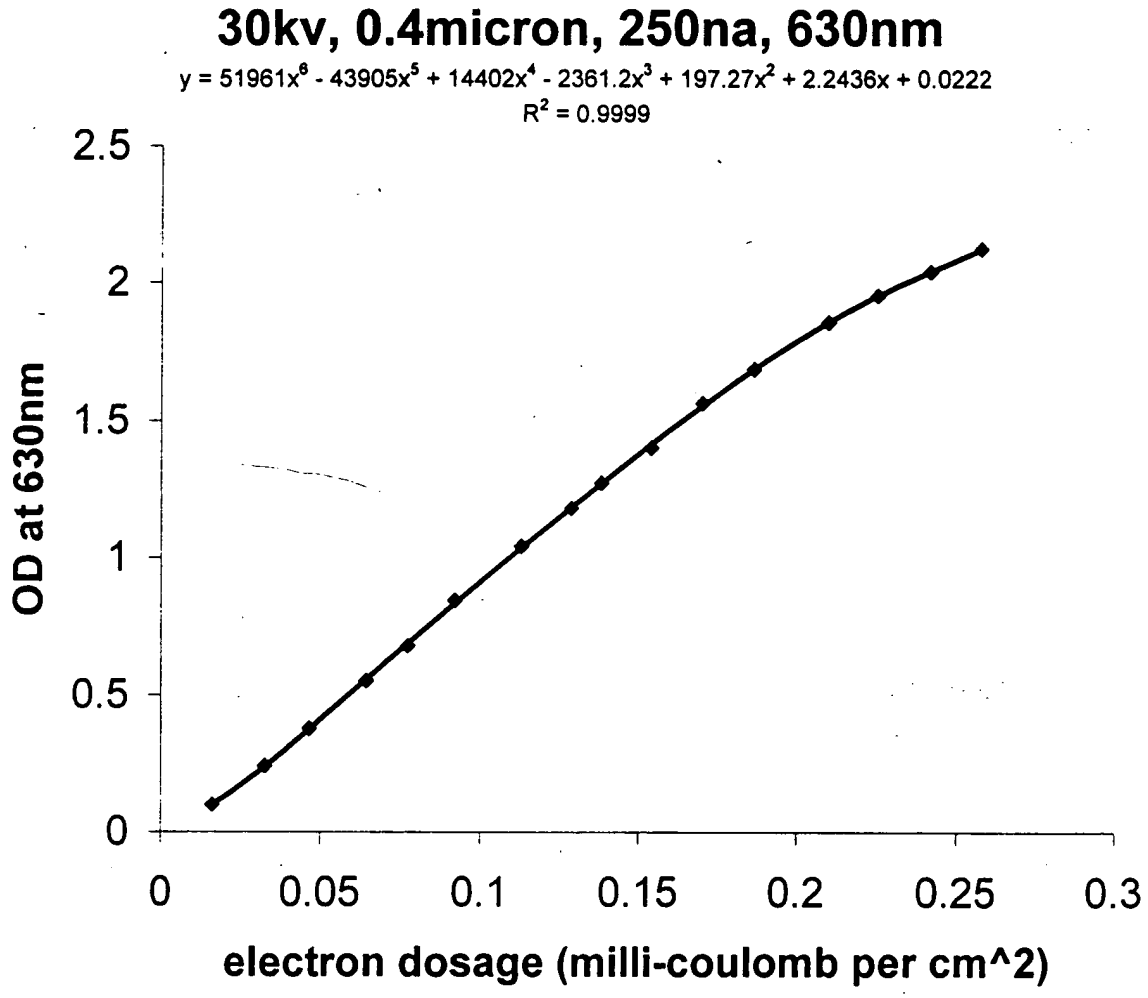


Fig. 7 (g)

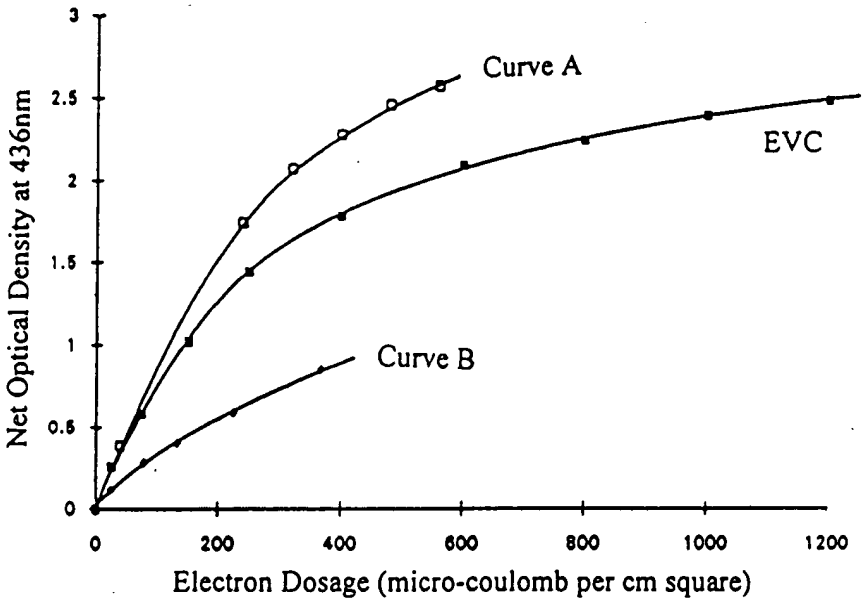


Fig. 8

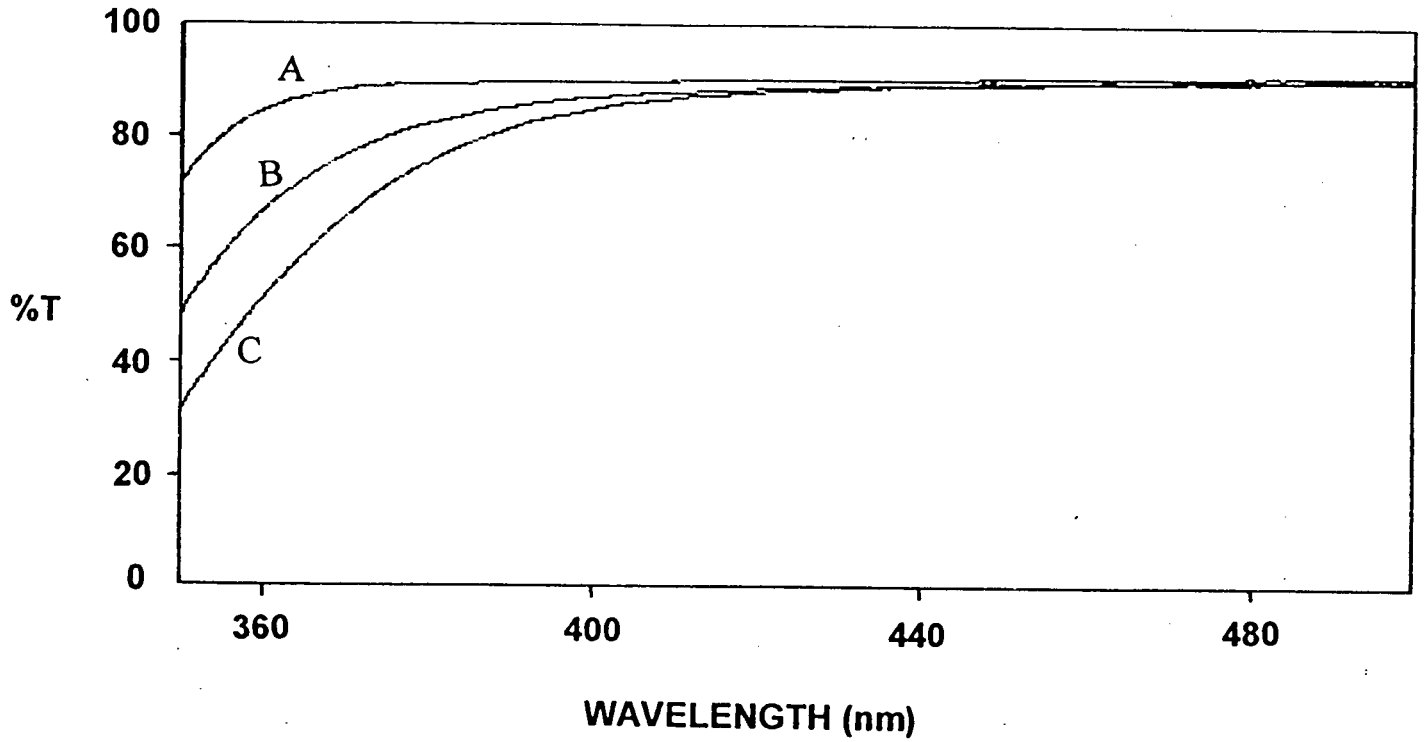


Fig. 9

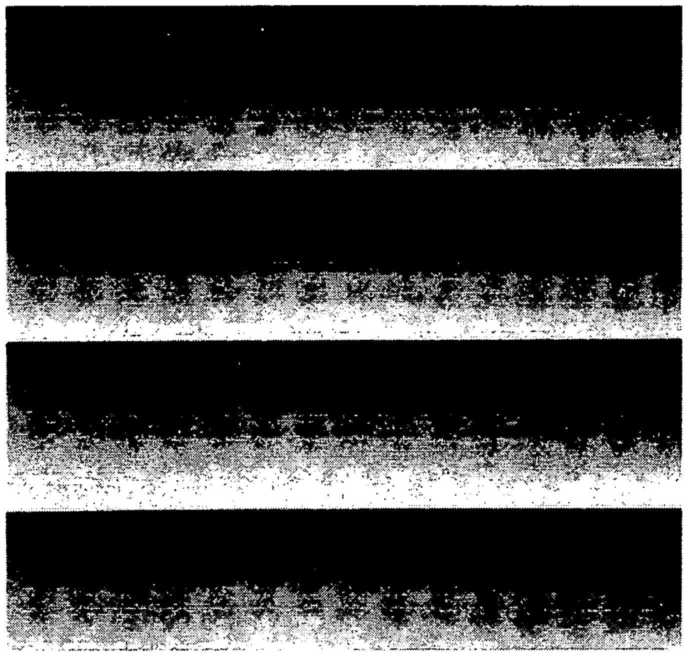


Fig. 10

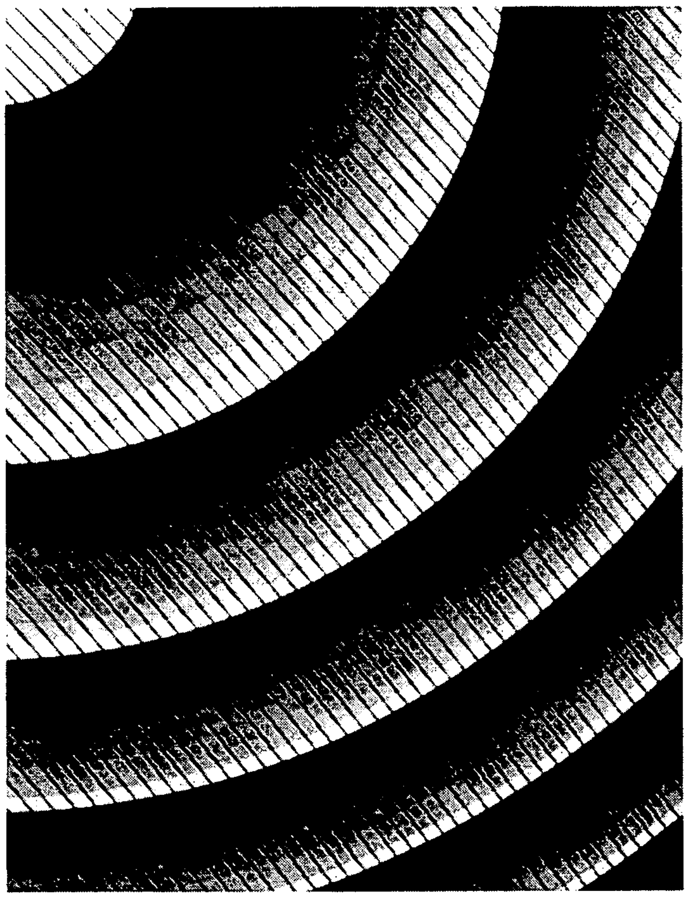
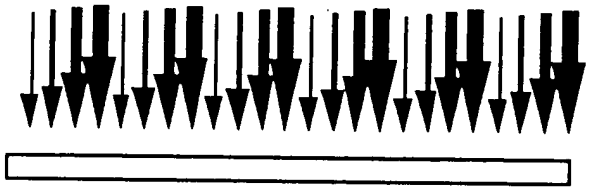


Fig. 11



a.) HEBS-Glass mask material exposed in e-beam writer

b.) Gray-Level mask generated in HEBS-Glass

c.) Photoresist exposure in optical lithography tool

d.) Resist surface profile after development

e.) Surface profile in substrate material after CAIBE transfer step

Fig. 12

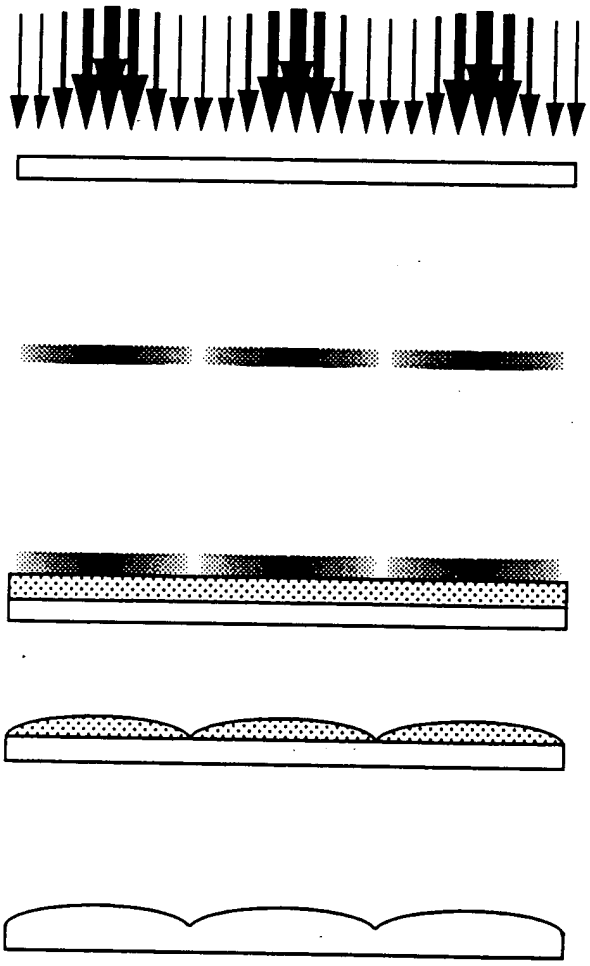

HEBS-Glass material exposed in e-beam writer
Gray-Level mask generated in HEBS-Glass
Photoresist exposure in mask-aligner
Resist surface profile after development
Lens profile after etching transfer step

Fig. 13

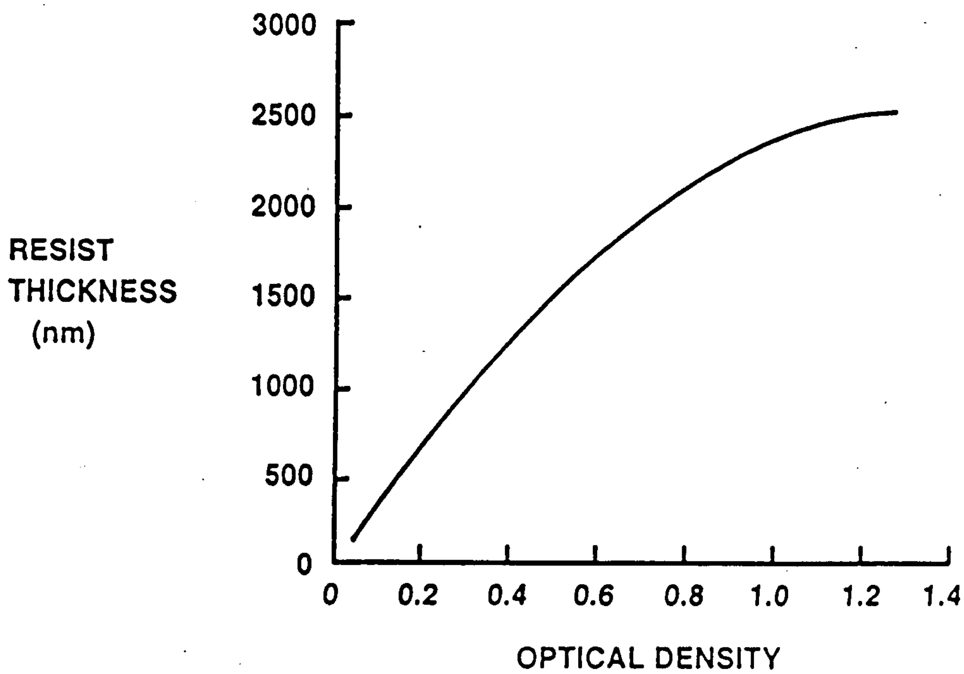

RESIST
THICKNESS
(nm)
3000
2500
2000
1500
1000
500
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
OPTICAL DENSITY

Fig. 14

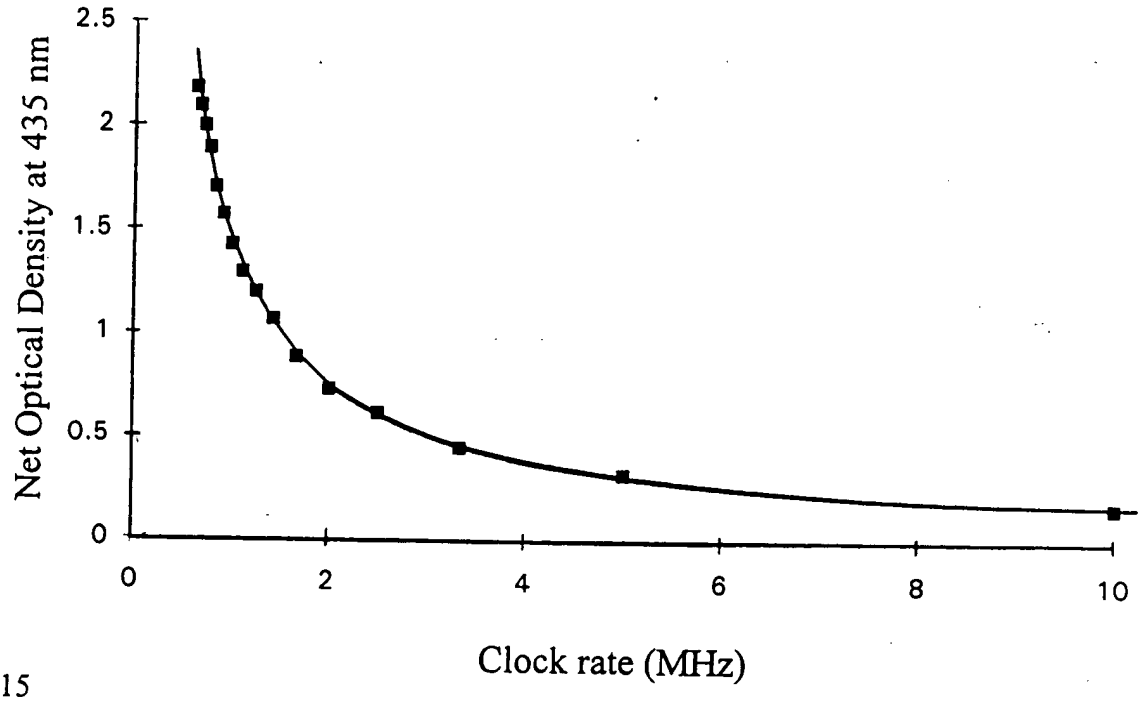


Fig. 15

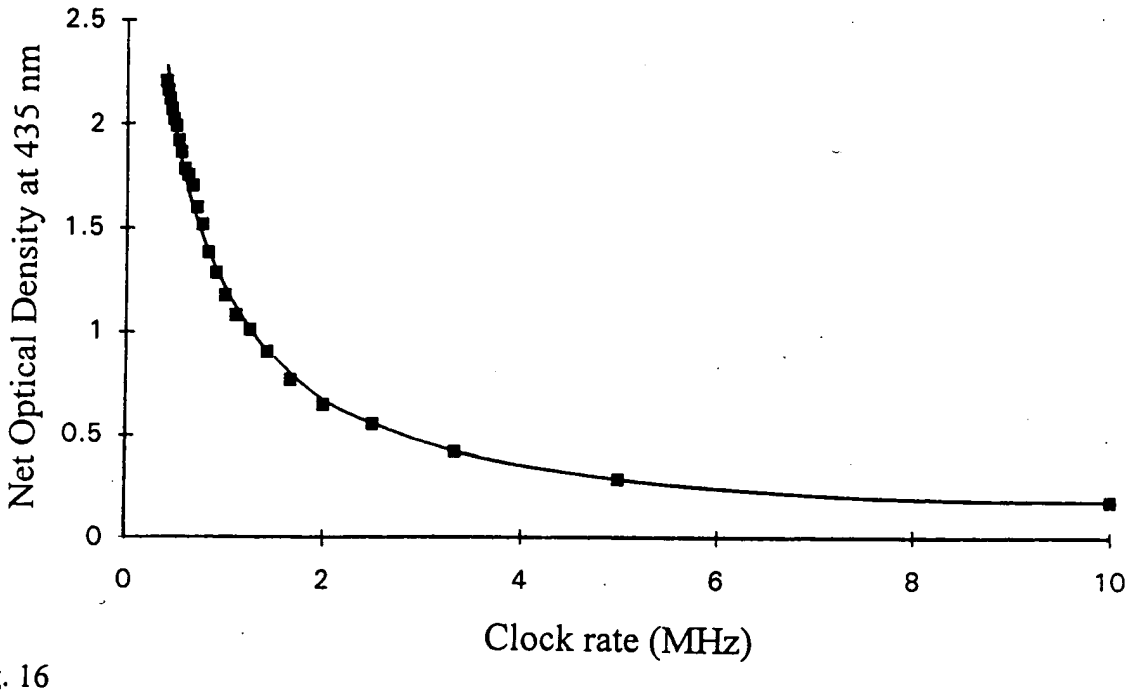


Fig. 16

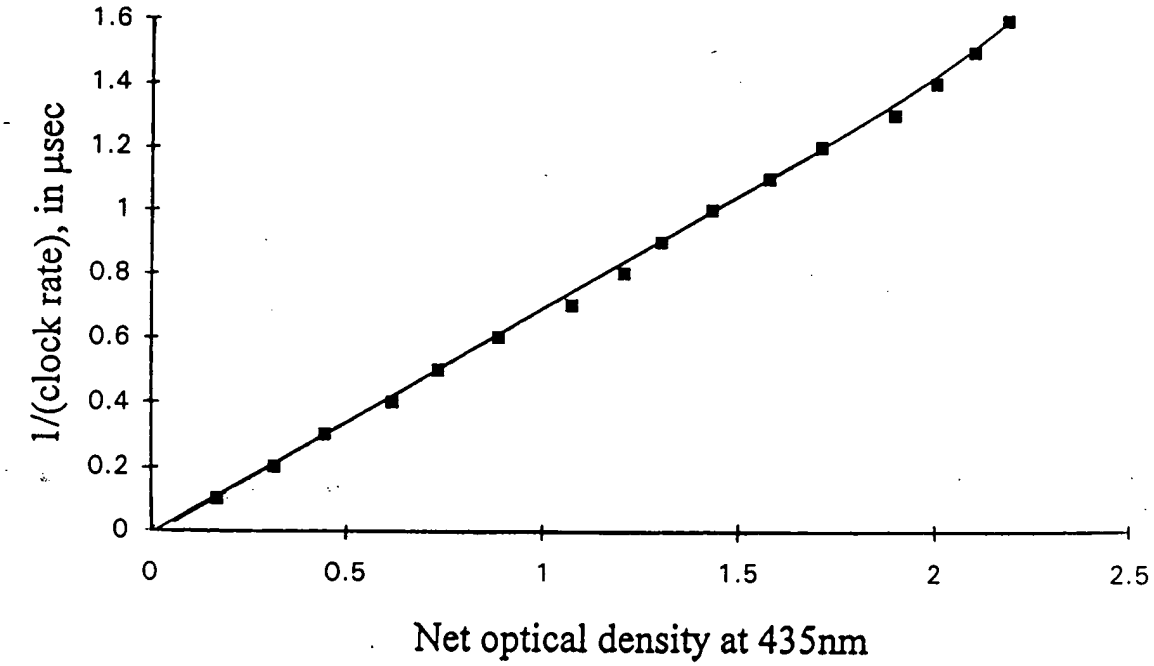


Fig. 17

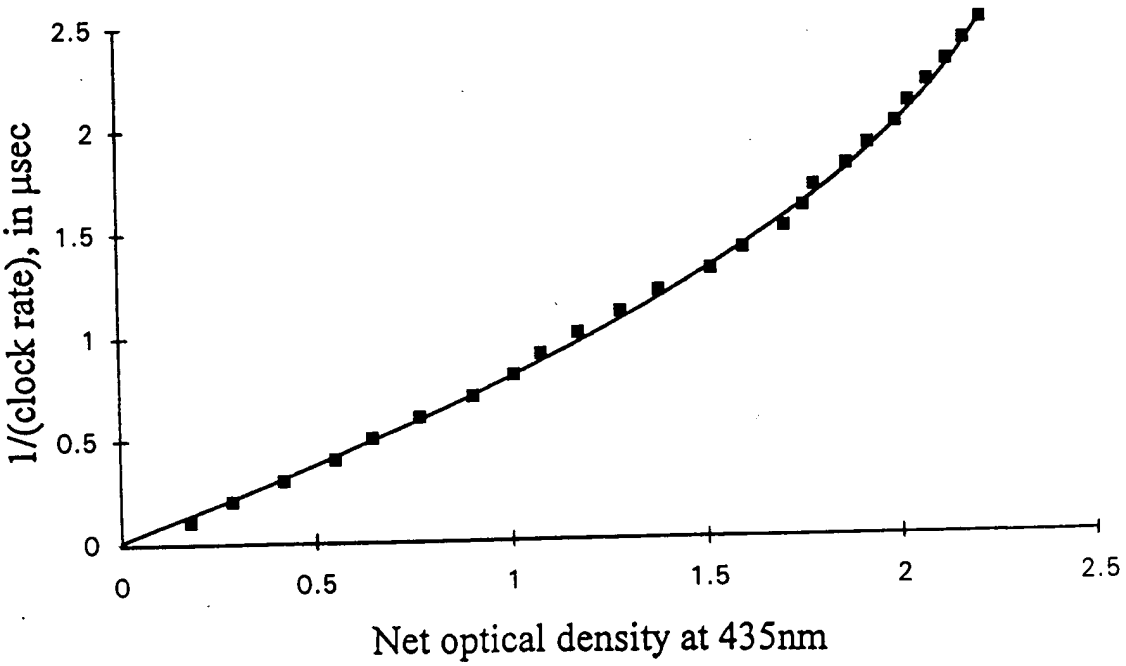


Fig. 18

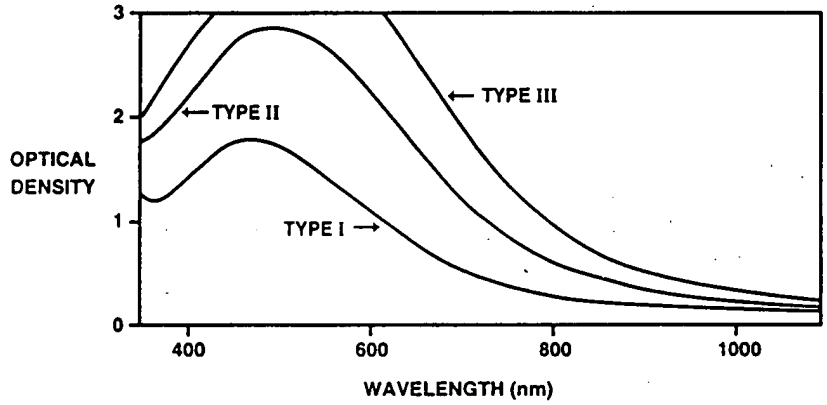


Fig.19

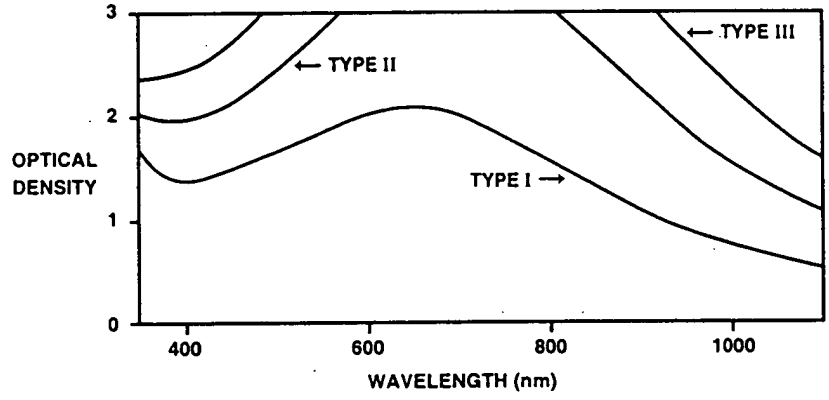


Fig.20

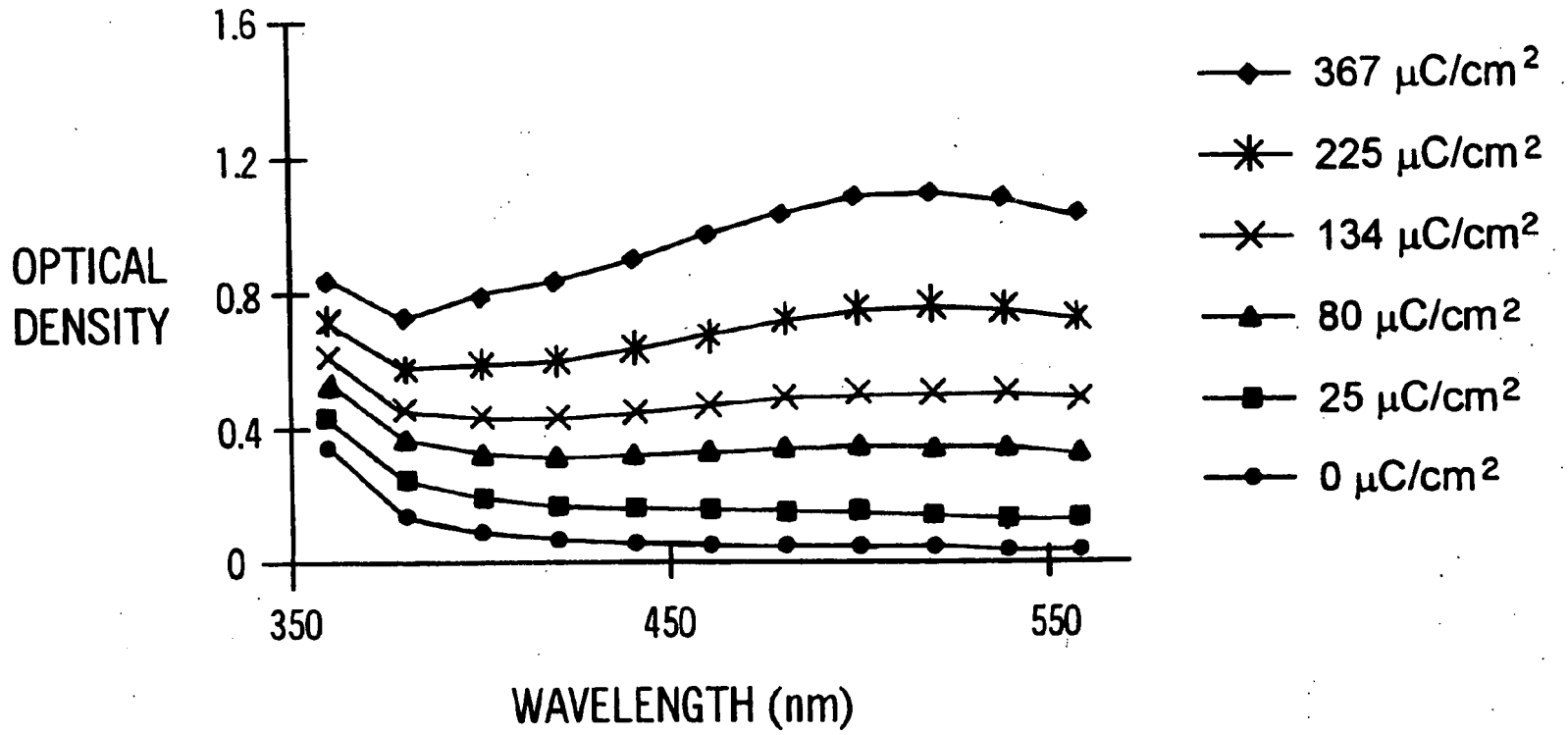


FIG. 21

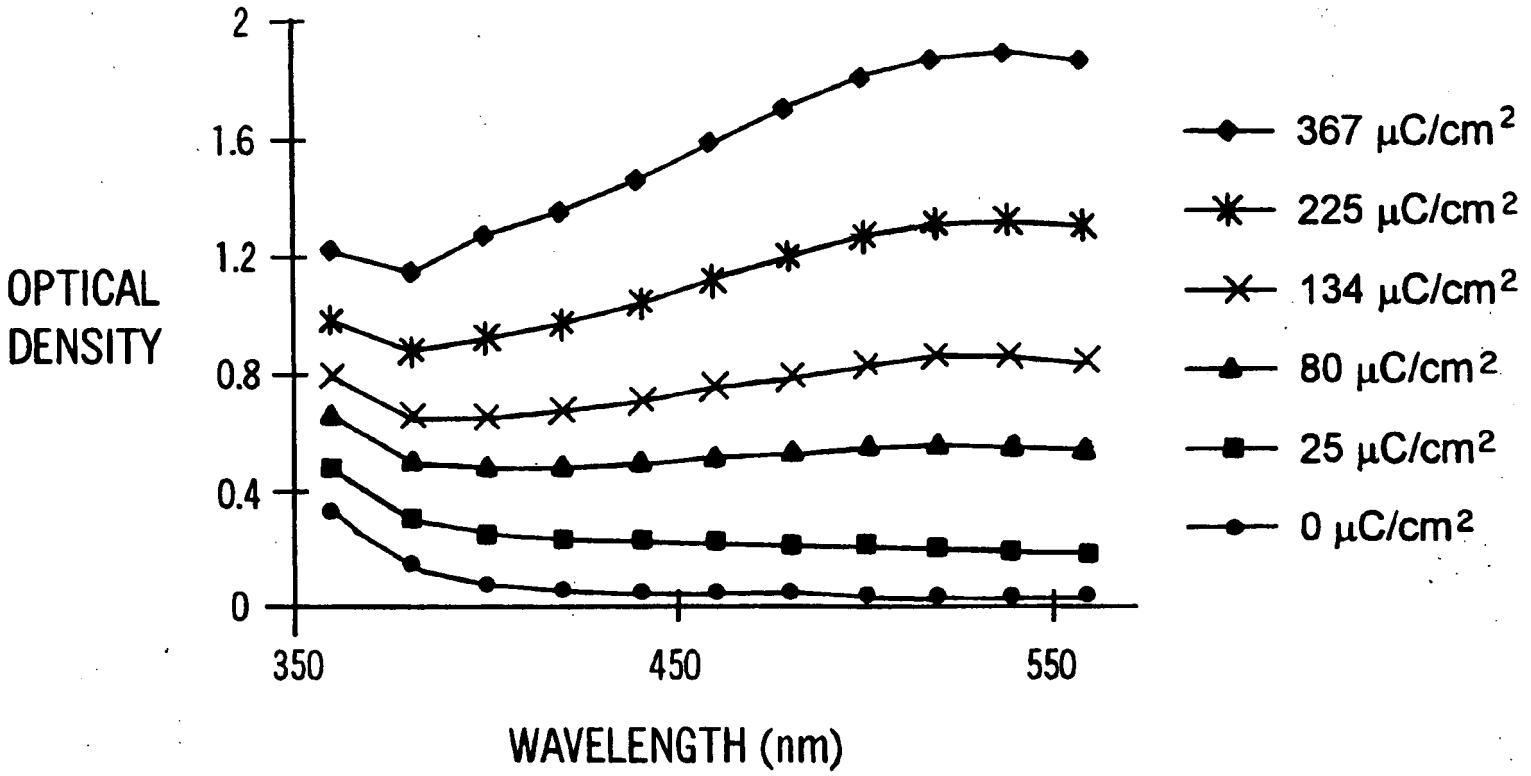


FIG. 22

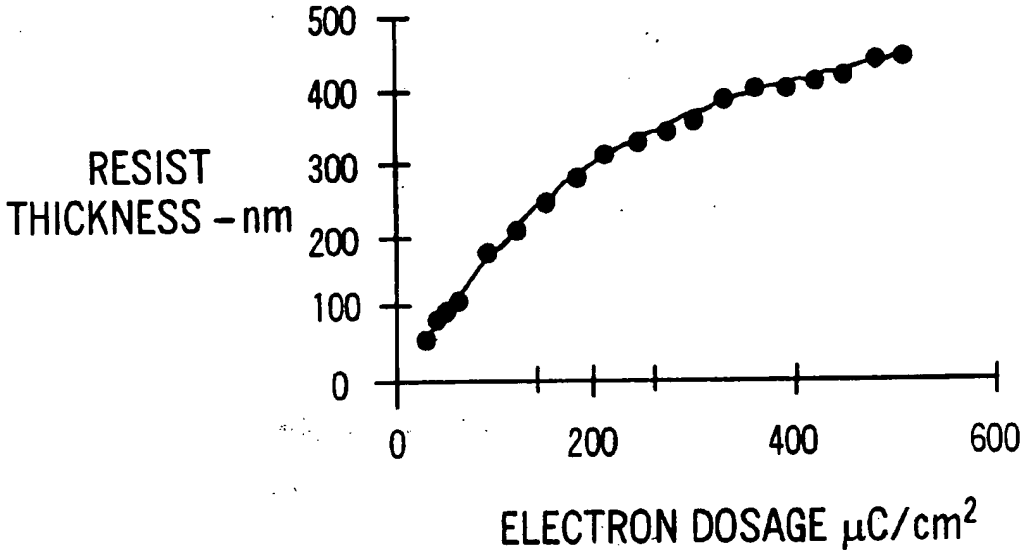

RESIST
THICKNESS – nm
500
400
300
200
100
0
0
200
400
600
ELECTRON DOSAGE μC/cm²

FIG. 23

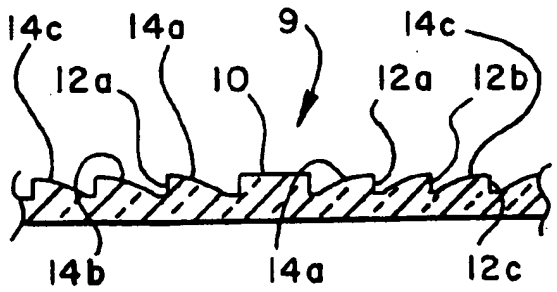

14c
14a
9
14c
12a
10
12a
12b
14b
14a
12c

FIG. 24

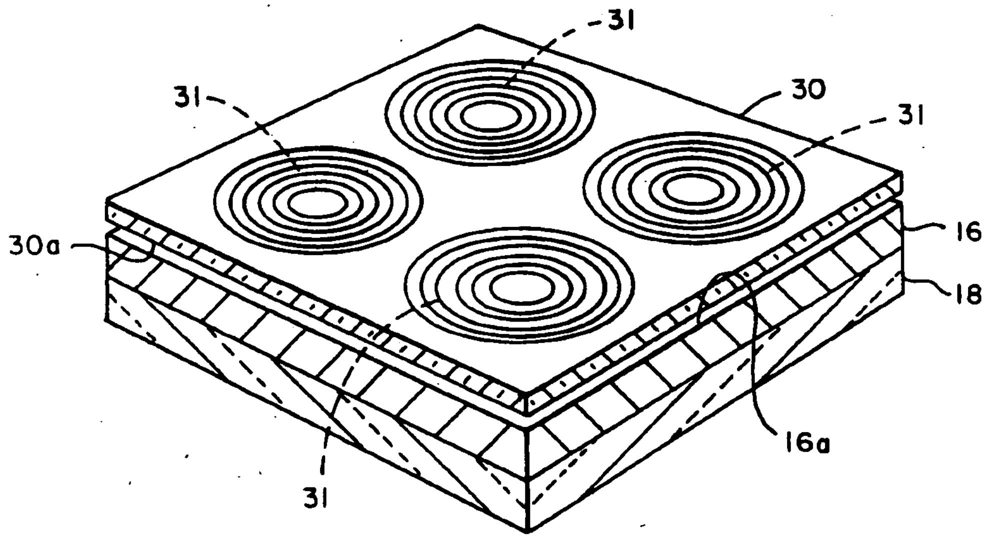


FIG. 25A

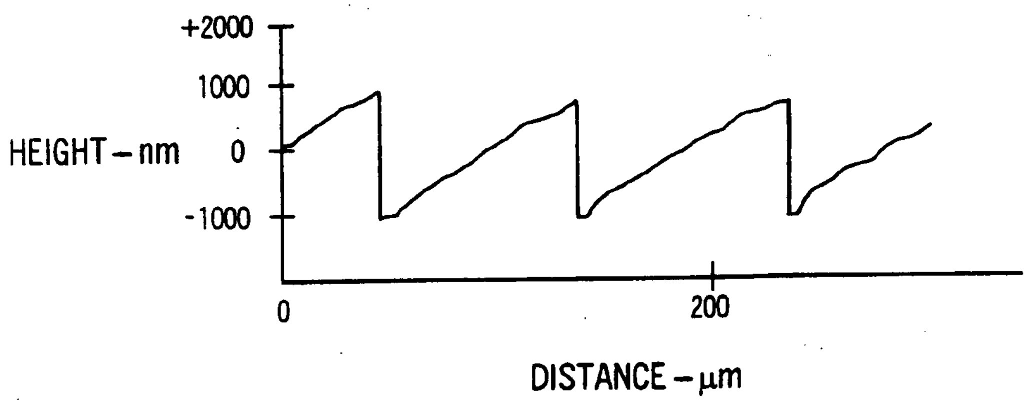


FIG. 25B

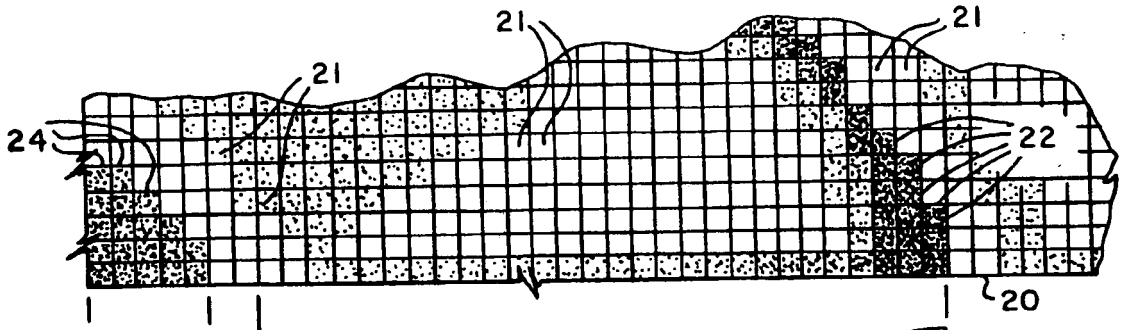


FIG. 26

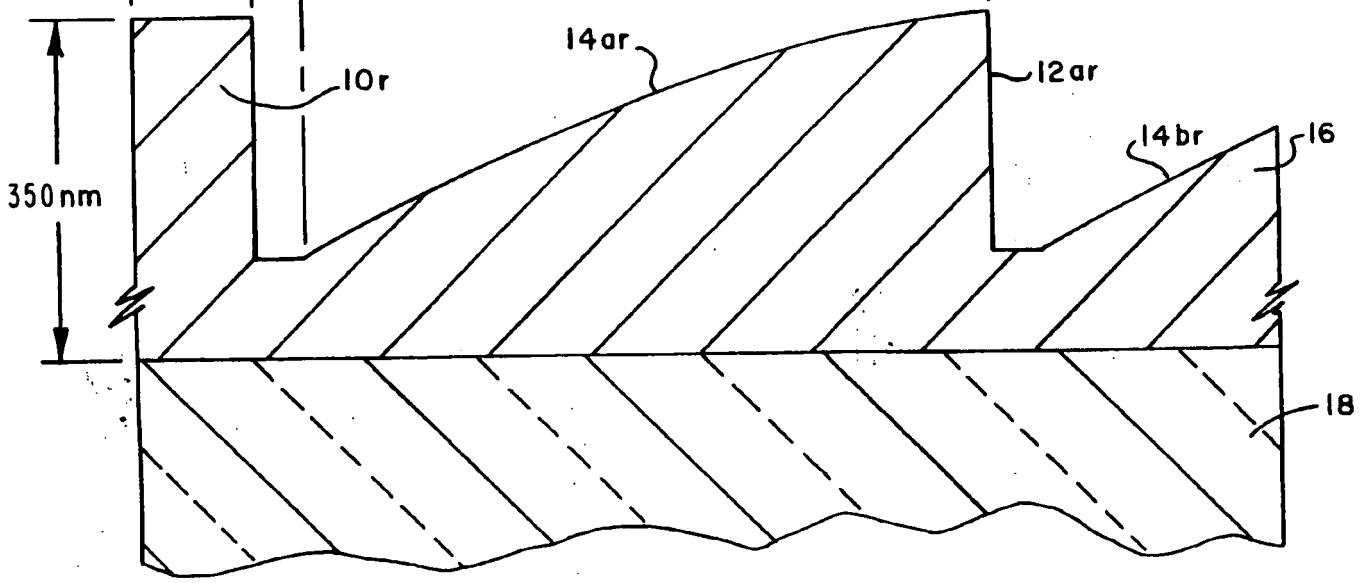


FIG. 27